Space Weather Technical Forecast

Issued on Tuesday 18 February 2025 at 12:40 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: M-class flares likely. Chance of Active fluence.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate, with the peak flare M1.0 at 17/1513 UTC, from AR3992. There are currently eleven sunspot regions on the visible disc. AR3992 is now rotating off the west limb. AR3990 has faded over the last 24 hours and is reverting to a more straightforward magnetic structure. However, this region does have a connected filament extending to its southeast, which has recently become unstable and will continue to be monitored for any potential lift-off. AR3996 in the southeast has shown some growth of intermediate spots, but remains fairly simple magnetically. Also in the southeast, AR3998 has shown some growth perhaps with a weak delta spot developing in one of the intermediate areas. The remaining regions appear relatively simple at present.

No Earth-directed CMEs have been observed. The filament near AR3990 showed some instability starting around 18/0000 UTC, but no CME is apparent in available imagery.

Solar Wind / Geomagnetic Activity: Solar winds as measured by ACE and DSCOVER at L1, showed a connection to a fast wind from CH15/-. Wind speeds were slightly elevated or elevated, varying between 450-530 km/s. Density was around or below average. Interplanetary Magnetic Field, Bt, was mostly weak, but recently reached moderate around 8nT. The north-south component, Bz, varied weakly between +7/-6nT. Phi angle was mostly negative (towards the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) at GOES18 persisted at background levels. High energy electron flux (greater than 2MeV) at GOES16 was moderate to high, peaking at 4780pfu at 17/1650UTC. The associated 24-hour fluence decreased below the Active threshold (1e8 integrated pfu), with the 18/0000UTC observation being 9.5e7 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to be Low to Moderate, with isolated M-class flares likely.

Solar Wind / Geomagnetic Activity: There are no CMEs currently assessed as Earth directed, however a couple of weak ejections from 14-15 Feb may pass nearby, with glancing influence possible on Day 1 (18 Feb). Otherwise, elevated solar wind speeds are expected to gradually ease

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to background as the influence of CH15/- wanes. Geomagnetic activity will be Quiet to Unsettled with a chance of Active intervals on Day 1 if any CME arrival occurs.

Energetic Particles / Solar Radiation: High energy proton flux is expected to persist at background levels, with a slight chance of rising above S1 in response to any larger flares. High energy electron flux is expected to remain moderate to high. There is a reducing chance of electron fluence reaching above the Active (1e8 integrated pfu) threshold in the coming days.

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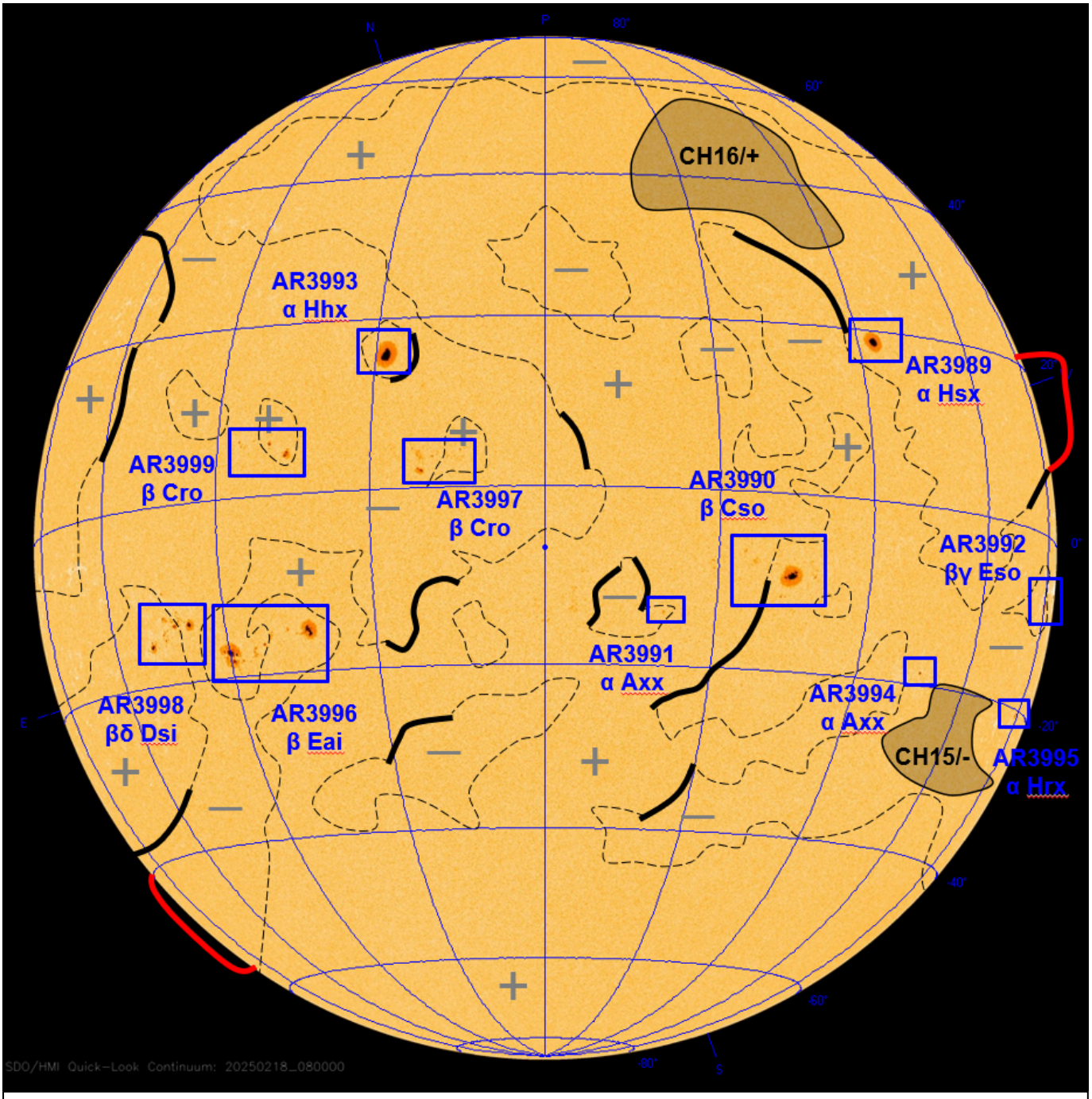
Figure 1: Solar synoptic map, valid at 18/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

Several CMEs were observed leaving the Sun on February 14th and 15th, mostly originating from AR3990 or AR3994, and from a filament eruption. Confidence in all of the CMEs is low, with limited coronagraph imagery for analysis and an apparent eastward deflection of the CMEs, likely due to CH15/-. However, these are currently expected to miss Earth, passing behind, with only a slight chance of glancing impacts on Day 1 (18 Feb).

Otherwise the ongoing fast wind conditions, now originating from CH15/-, are expected to to continue gradually easing from elevated to background levels by the end of the period. This is supported by MOSWOC Enlil.

Geomagnetic activity will be Quiet to Unsettled with a chance of Active intervals on Day 1 if any CME arrival occurs.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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Figure 2: MOSWOC Enlil, showing a gradual decline in wind speeds over the next few days.

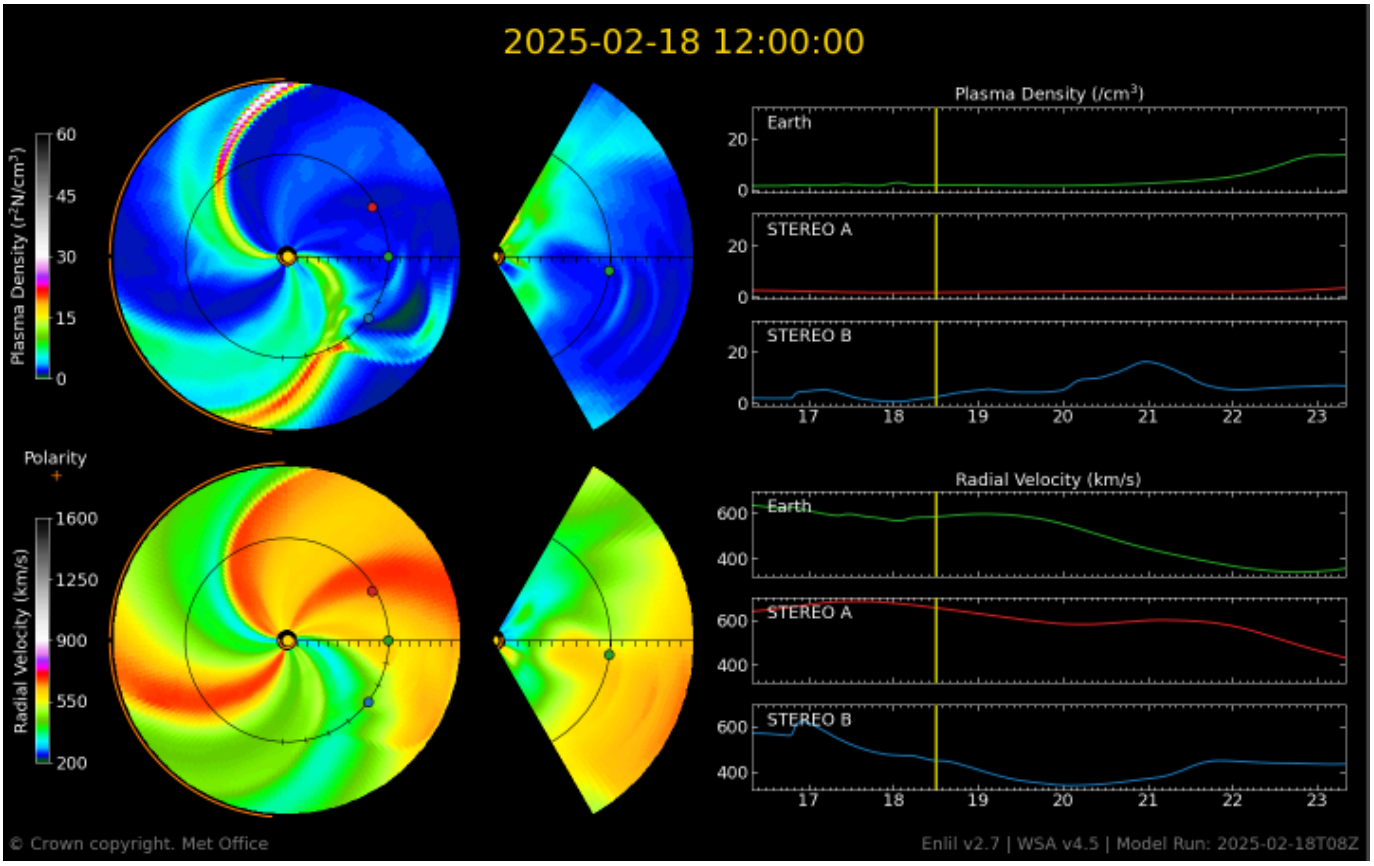

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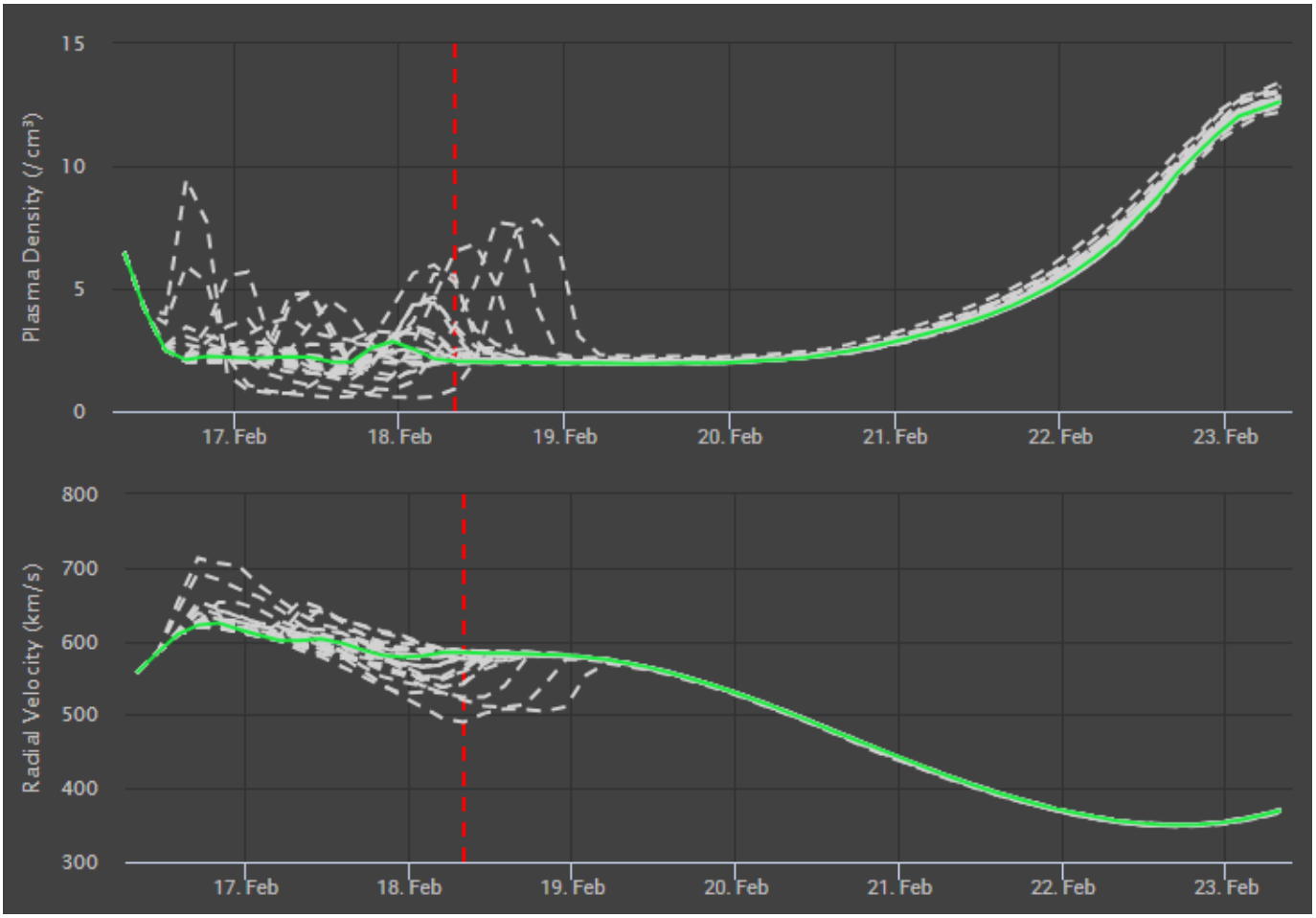
Figure 3: Enlil ensemble, showing the slight chance of a CME glance today.



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Radio Blackouts - X-Ray Flares

Solar activity has been Moderate, with the peak flare M1.0 at 17/1513 UTC, from AR3992.

There are currently eleven sunspot regions on the visible disc. AR3992 is now rotating off the west limb, so it can no longer be fully seen. AR3990 has faded over the last 24 hours and has now lost its opposite polarity spots, reverting to a more straightforward magnetic structure. However, this region does have a connected filament extending to its southeast, which has recently become unstable and will continue to be monitored for any potential lift-off. AR3996 in the southeast has shown some growth of intermediate spots, but remains fairly simple magnetically. Also in the southeast, AR3998 has shown some growth perhaps with a weak delta spot developing in one of the intermediate areas. The remaining regions appear relatively simple at present.

Activity is forecast to be Low to Moderate, with isolated M-class flares likely. These perhaps most probable from the developing regions on the eastern disc, or perhaps from AR3990 if any disruption occurs with its connected filament.

X-Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 (M Class)	Yes	60	60	60	60
Very Active	R3-R5 (X Class)	No	5	5	5	5

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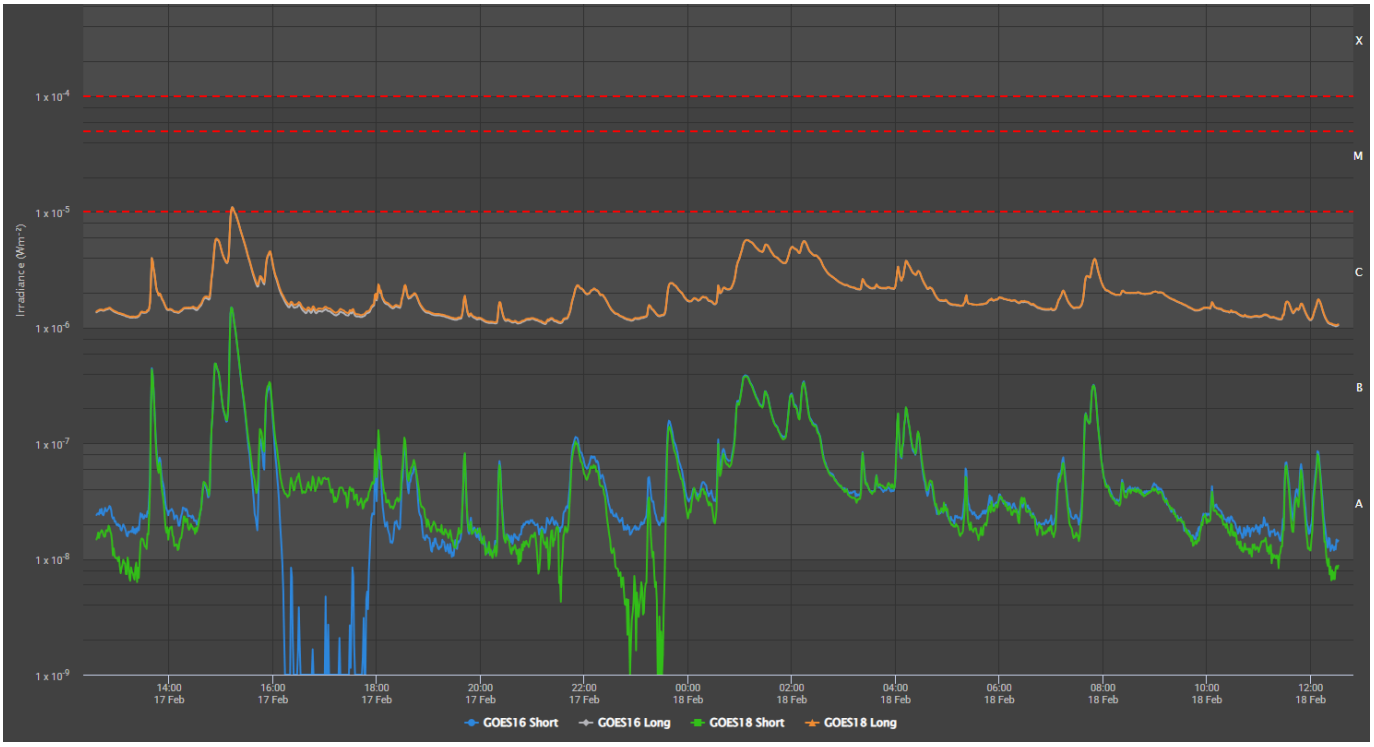
Figure 4: X-ray flux at GOES16 and 18, with one low level M-flare in the last 24 hours.



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Solar Radiation Storms (High Energy Protons)

GOES18 high energy proton flux is most likely to persist at background levels, but with a slowly increasing chance of enhancement due to any flaring from AR3990 as this region moves further across the better connected western hemisphere. Along with an increasing risk from AR3996 and AR3998, and other developing regions, as they move towards the centre disc, this brings a slight chance of the observed flux rising above the S1/Minor radiation storm threshold.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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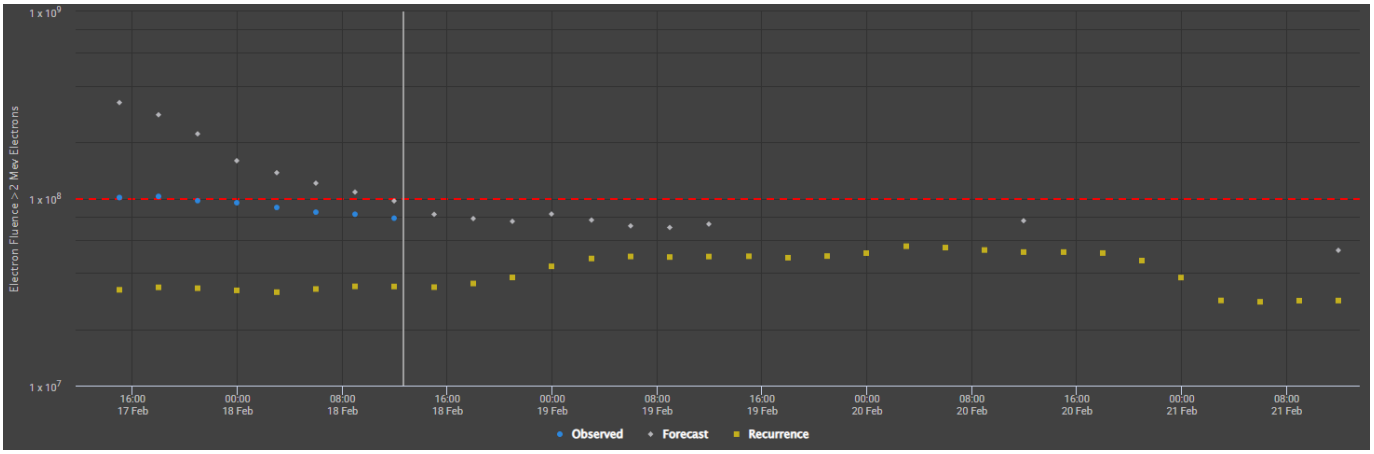
High Energy Electrons (≥ 2MeV)

High energy electron flux as observed at GOES-16 has been Moderate to High, due to the charging within the Van Allen Belt that recently occurred from the connection to the fast wind of CH14/15. As solar winds continue to ease, this charged environment is expected to largely persist, although there are signs of a decreasing trend with the current observations running lower than they were 24 hours previously. However, there is just a chance of the easing wind speeds allowing increased flux from lower orbits to expand towards GEO, so a renewed rise is not completely out of the question. There is also a potential CME glance possible on the 18 Feb, and while this is now considered unlikely to occur, this could help to drop out the observed flux. Overall, confidence is quite low.

The associated 24 hour fluence did reach the Active (1e8 integrated pfu) threshold on 17 Feb, but has since dropped below the Active level. Fluence is likely to remain close to or just below the Active threshold. Confidence for Active fluence on Days 1-3 (18-20 Feb) is low, but there is a chance of this occurring. MOSWOC REFM is now also forecasting fluence levels to drop below Active.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	Yes	50	40	30	20
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

Figure 5: MOSWOC REFM, showing fluence just below Active on a declining trend.



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